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Migration Statistics

Filling the 'migration gaps' — can research outcomes help us improve migration statistics?

Note by the Statistical Office of the European Union (Eurostat)

Summary

Migration statistics are known to be the most challenging part of demographic accounting. While continuing efforts to harmonise definitions and find new data sources have certainly improved the availability and quality of information on migratory flows, coherence/consistency in national and international migration data may still be the exception rather than the rule. Several research projects in recent years have helped by improving migration statistics, detecting alternative sources, sharing best practice or proposing estimation methods which address the quality and completeness of migration data. This paper explores the possible means offered by the research outcomes of dealing with the inherent uncertainty of migration data, and their potential use in the regular production and/or validation of official migration statistics.

The paper is presented for discussion to the Conference of European Statisticians seminar on migration statistics.

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I. Introduction: the issue of gaps in mirror migration statistics

1. In the first twelve years of the new millennium, the population of Europe[1] saw growth of 2.5 %, of which three-quarters is attributable to migration. Developments in the European Union specifically were similar, with its population expanding by 3.6 % over the same period and net immigration of over 13 million persons. In several countries, migration was on a scale sufficient to cancel out the natural decline in the population. Correct estimates of migration flows and stocks are thus of paramount importance.

2. Population size and structure can no longer be properly gauged without an accurate estimate of migration. The role that migration has assumed in European population dynamics imposes a 'statistical duty' of coherence between the factors in the fundamental demographic balance equation: $P(t+1) = P(t) + B(t) - D(t) + I(t) - E(t)$, i.e. the population at the end of the year is the sum of the population at the beginning of the year, plus natural change expressed by the difference between live births (B) and deaths (D), plus the net number of migrants entering (I, immigrants) or leaving (E, emigrants). The population cannot be computed if migration flows are not measured properly.

3. Even if coherence is achieved within the demographic balance of a country, comparability at international level may still be a challenge. Unlike vital events or population data, logically, migration statistics recorded in the countries from/to which the flows originated/went should correspond. Common sense dictates that national sets of migration figures should be at least approximately consistent. In simple terms, the number of immigrants recorded in country A as coming from country B should match the number of emigrants from country B heading for country A. Unfortunately, this is hardly ever the case.

4. The issue of mismatching mirror statistics in migration is a longstanding one. As long ago as 1975, the Conference of European Statisticians (CES) noticed the discrepancies between immigration and emigration flows involving the same pair of countries in an origin/destination matrix of migratory flows in 1972. A number of reasons for these migration 'gaps' were identified at the time: differing definitions of 'immigrants' and 'emigrants', different statistical coverage, differences in the statistical treatment of temporary migrants, a lack of consistency in classifying migrants by country of origin/destination, and differences between countries in the data sources and methods of collection used (Kelly 1987).

5. These observations triggered a range of activity, in both the research and statistical fields. Statisticians have sought to improve the comparability of migration statistics, adapting national to internationally recommended definitions (to varying degrees), exchanging mirror data with correspondent countries and/or carrying out bilateral studies. Researchers have developed a variety of methods to overcome inconsistencies in migration data. However, over 40 years later, migration statistics still present significant inconsistencies. The latest statistical evidence from selected European countries shows that the number of immigrants from country A measured in destination country B can differ from the number of emigrants to country B measured in country of origin A. This also

[1] For statistical convenience, 'Europe' refers here to the 44 countries for which data were available and does not reflect any opinion on the part of the European Commission concerning the legal status of any country, territory or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

occurs between countries which should in principle provide harmonised statistics of migration flows.

6. Although much of the focus is now on migrants' socio-economic characteristics, measuring their integration and links between migration and the labour market, this needs to be based on an accurate idea of immigrant/emigrant numbers – otherwise, any secondary information will be distorted. This note explores the opportunities and challenges involved in applying the results of research on migration statistics in regular data production. Section II briefly shows (without entering into policy issues) the specific analytical relevance of migration statistics for the European Union (EU), which has made the EU a popular case study. Section III summarises a number of outcomes from academic and statistical research and major projects supported by the EU in recent years. Section IV opens a discussion on some potential issues regarding the adoption of estimation methods in migration statistics. A few concluding remarks are made in the last section.

II. The European Union as a case study for migration statistics

7. Migration statistics have played a key role in numerous policy actions in recent years. Acknowledgement of immigration as an important resource in a country's population dynamics and a greater focus on the implications of emigration have helped raise awareness of the statistical information available. Among other action in this field,[2] in 2008 the Council of the European Union formally established the European Migration Network (EMN), which is geared to supporting policy-making by providing Community institutions and Member State authorities with up-to-date, objective, reliable and comparable information on migration and asylum.[3] The latest EMN conference called for a stronger evidence base, including more analyses of migration statistics (EMN 2013).

8. The EU regulations on migration statistics[4] are a milestone in this field. Since their entry into force, a large number of European countries have worked to deliver more harmonised migration statistics. The regulations were the outcome of a two-decade-long process launched in response to rapidly growing interest in migration statistics and realisation of the need for harmonisation at EU level (Poulain 1991).

9. However, as noted above, such efforts are not sufficient to provide completely consistent and high-quality information on migration flows in the EU. Acknowledging the inherent difficulties in measuring such phenomena, the regulations provided for the application of 'scientifically based and well documented statistical estimation methods' (Article 9 of Regulation (EC) No 862/2007). The combination of policy relevance and endorsement in EU law may well have been a factor in (if not the root cause of) the resurgence of scientific work in the area of migration, with many recent contributions focusing on the problems of statistical estimation in the EU context.[5]

10. The peculiarity of the EU means that some observers regard intra-EU migration as 'internal' rather than international. This provides additional justification for the adoption of

[2] For more information on EU immigration policies, see http://ec.europa.eu/dgs/home-affairs/what-we-do/policies/immigration/index_en.htm and http://ec.europa.eu/dgs/home-affairs/what-we-do/policies/international-affairs/global-approach-to-migration/index_en.htm.

[3] Council Decision 2008/381/EC establishing a European Migration Network (OJ L 131, 21.5.2008, p. 7).

[4] Regulation (EC) No 862/2007 on Community statistics on migration and international protection (OJ L 199, 31.7.2007, p. 23) and its implementing measures.

[5] This is not to say that similar problems do not apply in other parts of the world (see, for example, Van Hook and Bachmeier 2013, Judson and Swanson 2011, Massey and Singer 1995).

estimation methods hitherto applied in inter-regional migration models. Also, the EU may intuitively be considered a 'migration system',[6] or set of migration systems, which also makes it interesting from a theoretical point of view.

11. The particular impact of the economic crisis on some European countries provides a further opportunity for EU-specific analyses using migration data. As shown by Herm and Poulain (2012), it is essential to ensure that time series are consistent – a real challenge considering the changes in national methodology, definitions, etc. that have characterised this field over the years. Proper assessment of migration patterns and trends requires the reconstruction of reliable time series of past immigration and emigration.

III. A short review of research on European migration statistics

12. Several projects on migration statistics have been funded by the European Commission, particularly under the 5th, 6th and 7th Research Framework Programmes; these include (in chronological order):

(a) January 2001-October 2002: *the Comparing National Data Sources in the Field of Migration and Integration* (COMPSTAT) project[7] took initial steps to overcome the lack of comparable data in 10 European countries (Austria, Belgium, the Czech Republic, Germany, Hungary, Italy, the Netherlands, Norway, Poland and Switzerland);

(b) April 2004-August 2005: the *Towards Harmonised European Statistics on International Migration* (THESIM) project[8] was aimed at supporting implementation of the EU regulation on migration statistics and helping countries comply with their obligations. The outcomes were also published in Poulain *et al.* (2006);

(c) January 2007-December 2009: the Eurostat-funded *Migration Modelling for Statistical Analysis* (MIMOSA) project[9] aimed to develop methods for reconciling differences in European countries' international migration statistics. The project produced estimates of migration flows and population stocks for the 31 EU and EFTA countries for 2002-07;

(d) March 2007-August 2009: the *Promoting comparative quantitative research in the field of migration and integration in Europe* (PROMINSTAT) project[10] produced an online database containing essential technical information on migration and integration for 29 European countries (EU-27 plus Norway and Switzerland);

(e) September 2007-August 2009: the *Irregular Migration: Counting the Uncountable. Data and Trends Across Europe* (CLANDESTINO) project[11] aimed to provide an inventory of data and a new method for evaluating estimates of irregular migration (stocks and flows) in selected EU countries (Austria, Germany, Greece, Hungary, Italy, the Netherlands, Poland, Portugal, Slovakia, Spain and the United Kingdom). It set up

[6] Although not as yet the subject of commonly accepted definition and application, the term 'migration system' basically refers to a network of places linked by flows and counter-flows of people (see, for example, Bakewell 2013).

[7] The project website is no longer available; for some information, see http://www.efms.uni-bamberg.de/prsteuce.htm.

[8] http://www.uclouvain.be/en-7823.html.

[9] http://mimosa.gedap.be/.

[10] http://www.prominstat.eu.

[11] http://clandestino.eliamep.gr/.

a database on irregular migration,[12] hosted by the Hamburg Institute of International Economics (HWWI);

(f) Funded by the NORFACE Research Programme on Migration, the *Integrated Modelling of European Migration* (IMEM) project[13] aims to overcome the limitations of the various data sources, including inconsistent availability, definitions and quality, by applying Bayesian statistical methods.

13. Many other EU-funded projects have addressed (albeit not always as their primary objective) the availability and quality of migration data, and a number of databases have either been set up specifically or happen to give insights on determinants of migration which could also be used for estimation purposes (e.g. Kim and Cohen 2010). The following is a non-exhaustive list (in chronological order):

(a) October 2005-September 2007: the *Patterns of migration in the new European Borderlands: an assessment of post-enlargement migration trends in NIS border countries (Armenia, Belarus, Georgia, Moldova and Ukraine)* project, funded by the INTAS Programme and based on survey information in the five countries in question, explored the factors which influence migration duration and the choice of destination region (for an outcome of this research, see Danzer and Dietz 2008);

(b) January 2007-June 2009: the *Mediterranean and Eastern European Countries as New Immigration Destinations in the European Union* (IDEA) project[14] had as one of its main objectives the preparation of a model of future migratory trends in selected parts of the EU, based on a collection of data on population stocks and flows in the countries in question in 1985-2004. A book edited by Okólski (2012) sets out some of the outcomes;

(c) October 2008-January 2013: the *Migration between Africa and Europe* (MAFE) project[15] focused on migration flows between Europe (Belgium, France, Italy, the Netherlands, Spain and the UK) and sub-Saharan Africa (Senegal, the Democratic Republic of Congo and Ghana) and collected unique data on migrant characteristics and behaviour;

(d) January 2010-December 2014 (ongoing): the *Determinants of International Migration* (DEMIG) project[16] announces, in its call for papers for a conference at Oxford University in September 2014, empirical analyses of large-scale country-to-country migration flow databases, total in- and outflows, migration policies and visa requirements;

(f) June 2012-November 2014 (ongoing): the *Managing Migration and its Effects in South-East Europe — Transnational Actions Towards Evidence Based Strategies* (SEEMIG) project[17] has among its outputs an analysis of existing migratory data production systems and data sources, and a database of immigrant flows and stocks;

(g) Funded by the NORFACE Research Programme on Migration, the *Theorising the Evolution of European Migration Systems* (THEMIS) project[18] follows migration trajectories from certain regions in three origin countries (Brazil, Morocco and Ukraine) to selected cities in four destination countries (the UK, Norway, the Netherlands and Portugal).

[12] http://irregular-migration.net//index.php?id=157.

[13] http://www.norface-migration.org/currentprojectdetail.php?proj=3 or http://www.norface.net/526.

[14] http://www.idea6fp.uw.edu.pl/.

[15] http://www.mafeproject.eu/.

[16] http://www.imi.ox.ac.uk/projects/demig or www.migrationdeterminants.eu.

[17] http://www.seemig.eu/.

[18] http://www.imi.ox.ac.uk/projects/themis. See also http://www.norface.net/526 and http://www.norface-migration.org/currentprojectdetail.php?proj=11.

13. A number of contributions have been published in international scientific journals, in some cases independently of the above projects. The following is a (non-exhaustive) list of contributions over the past twenty years, most focusing on European countries and, in particular, migratory flows involving EU Member States:

(a) Poulain (1993) develops a basic idea proposed earlier (Poulain and Wattelar 1983) which involves applying correction factors to overcome migration gap problems in mirror statistics. Variants of this approach are developed by Abel (2010) and De Beer *et al.* (2010), the latter subsequently followed up by Raymer *et al.* (2011) with the estimation of missing data and a breakdown by age and gender.

(b) Willekens (1994) provides a first review of available methods in demography, geography and statistics which could have been applied to set up a consistent and coherent database on international migration, including a call for the inclusion of judgmental data. The same scholar presents various probability models from a statistical perspective, with particular attention to life history data (Willekens 1999a) and a probabilistic method for estimating migration from incomplete data using the 'expectation-maximisation' algorithm (Willekens 1999b).

(c) Nowok and Willekens (2011) propose a probabilistic model for migration processes, focusing on an assessment of the impact that different migration/migrant definitions have on measurements.

(d) DeWaard *et al.* (2012) extend an approach developed under the MIMOSA project to estimate international migration flows between 28 European countries (EU-27 and Norway) in 2003-07, additionally identifying three migration systems in the region.

(e) Abel (2013) proposes a method for estimating migration flows using place-of-birth data, linking migration flows to stocks.

(f) In the framework of another EU-funded project,[19] Cuaresma *et al.* (2013) develop a new method for estimating bilateral migration flows using an econometric specification of a gravity model based on net migration.

(g) Wiśniowski *et al.* (2013) show how experts' opinions can be incorporated in a Bayesian model to improve migration flow statistics; this can also be used to cover irregular migration.

(h) Raymer *et al.* (2013) propose a method for estimating migration flows that incorporates covariate information, experts' opinions and accuracy of data collection systems, and is accompanied by measures of uncertainty.

(i) Last, but definitely not least, are books written by Rogers *et al.* (2009), on migration estimation methods, and edited by Raymer and Willekens (2008), the latter specifically addressing the data harmonisation challenges presented by the EU Regulation.

14. Other contributions from national statistical offices have mainly addressed ways to improve the primary information, for instance by looking at the accuracy of national data sources (e.g. ISTAT-Italy 2008), reviewing definition and measurement issues (e.g. Statistics Austria 2008), comparing migration data systems in detail (e.g. Statistics Netherlands and Statistics Sweden 2010) or exchanging (ultimately micro-)data (INE-Spain 2013).

15. At international level, the practice of data exchange has been supported by the United Nations Economic Commission for Europe (UNECE), which has also issued guidelines on this (UNECE 2010), and Eurostat, which has set up a secured web repository for countries to exchange migration data before official release and document best

[19] *Welfare, Wealth and Work for Europe* (WWW for Europe): http://www.foreurope.eu/.

practices. Discussion has taken place on the impact of different definitions of migration (UNECE Task Force 2012) and more recently on new forms of migration, e.g. in the recently established UNECE Task Force on Circular Migration.[20] Finally, alternative data sources have been explored by the Suitland Working Group.[21]

IV. Discussion

16. The previous section highlighted just part of the wealth of methods now available to official statisticians for improving migration statistics. Although scientists must continue the quest for ever better methods, statistical offices responsible for producing and/or disseminating migration data can no longer ignore those already available. Nevertheless, the potential seems to date to have been under-exploited. One possible reason is insufficient awareness (as yet) of the progress achieved, or a sense that this is insufficiently conclusive. Also, implementation of some new methods in regular production may require particular technical skills, which may not be widespread. Thirdly, several of the methods, particularly those referring to the origin-destination matrix of migration flows, are better tackled at international level.

17. Other factors may hamper the implementation of research outcomes in regular migration data production. For the purposes of the current discussion, we can apply a (somewhat fuzzy) distinction between *statistics* and *estimates*, the former broadly representing the product of an (as far as possible) exhaustive compilation of records from primary data source(s), the latter the outcome of probabilistic/statistical models, possibly combining information from various sources. Migration data from sampling surveys would fall into this second category.

18. The United Nations Statistics Division (UNSD) and Population Division (UNPD) operate on the basis of this distinction. The UNSD collects official statistics from all countries, which the UNPD then uses to produce internationally consistent estimates of population and related components of change (including migration). However, the timeliness and granularity of the information made available by the UNPD may not be such as to meet the needs of regional policy-makers (e.g. in the EU).

19. Even when an estimation model is adopted, there are a number of potentially far-reaching consequences, summed up by the following questions:

(a) Should countries adopt the migration estimates as national figures?

(b) Should countries adjust their population figures accordingly?

(c) Can migration/population *estimates* be used for 'official' purposes, instead of 'original' migration/population *statistics*?

20. Whatever the national position on these questions (which may depend on domestic priorities), data comparability and completeness are a must for any international analysis. Estimates, in particular those relating to the origin-destination matrix of migration flows, are also an invaluable tool for data validation and quality assessment. However, it must be stressed that the adoption of any estimation method does not justify relaxing the commitment constantly to improve data sources and derived statistics.

21. In practice, where migration gaps are due to differences of definition, an estimation method that does not take this into account is 'forcing' consistency between estimates and

[20] For terms of reference, see http://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/bur/2013/15Add.1_-ToR_TF_migration.pdf.

[21] For more information, see http://www.unece.org/stats/groups/suitland/suitland.html.

mixing dissimilar measures. The outcome can be seen as referring to an undefined general concept of migration, of which the definitions are thus considered an approximation. This highlights once more the importance of continuous effort to produce data based on definitions that are as comparable as possible.

22. Some estimation methods may require further refinement/development before being directly applicable. In addition, various breakdowns, e.g. by age, sex, country of birth and citizenship, are of key interest, so consistency is important not only for top-level aggregated figures, but for the whole set of data.

23. A risk in neglecting the possibilities offered by estimation methods is that, in the absence of adequate migration data, users may turn to third-party estimates that do not necessarily meet statistical/scientific requirements; this may trigger potentially embarrassing disputes. If estimates have to be used, a statistical office is well advised to master them, also for the sake of complying with its overall duty to produce accurate information for the society it serves.

24. Ideally, the application of estimation methods should be managed at international level. Even if a country adopts a particular method, the outcomes may not match those from another method applied in another country – there would be a mismatch of estimates rather than statistics! It seems, therefore, that action is needed at international level to coordinate the implementation of estimation methods in migration statistics.

V. Concluding remarks

25. The policy relevance and intrinsic international nature of migration call for national statistical offices to continue working towards the full harmonisation of relevant data. In view of the role now played by migration in national population dynamics, such efforts should be seen in the framework of harmonising population statistics in general: migration statistics can no longer be regarded as separate or negligible.

26. While countries are undeniably entitled to adopt particular approaches for their own purposes, in a globalised world there is a clear need to move towards a *single* concept of 'population' for international statistical purposes, including a common definition of 'migration'. The perpetual debate as to how to define 'population' ('usually resident' vs. 'registered' vs. 'legal population', etc.), the challenges engendered by greater mobility and inter-connectedness, and the varying concepts of 'population' underlying national statistical (and sometimes legal) systems may mean that a paradigm shift is required (see, for example, Eurostat 2013).

27. After forty years of inconsistent migration data at international level, a move forward is now called for. The research community has been suggesting solutions for some time and, although estimation methods can hardly replace accurate data sources, statisticians have a valuable set of tools at their disposal, for now mainly as regards numbers of immigrants and emigrants by country of origin/destination. Although some techniques may be considered insufficiently mature as yet, mirror tables are an easy-to-build indicator of the international consistency of migration statistics, and consistent sets produced using estimation methods can be a precious source of support for data validation and assessment. In migration statistics, *filling the gaps* in the mirror tables involves *bridging the gaps* between statisticians and researchers.

28. Given its official role in collecting migration data from EU Member States and the benefits of an international approach, Eurostat might now consider investigating the technical pros and cons, and performance, of the various methods of migration estimation, in view of their regular application.

VI. References

Abel, G.J. (2010): "Estimation of international migration flow tables in Europe". *Journal of the Royal Statistical Society*, 173(4):797-825.

Abel, G.J. (2013): "Estimating global migration flow tables using place of birth data". *Demographic Research*, 28(18):505-546.

Bakewell, O. (2013): "Relaunching migration systems". *Migration Studies*, Advance Access. First published online November 15, 2013 doi:10.1093/migration/mnt023.

Cuaresma, J.C., M. Moser and A. Raggl (2013): "On the Determinants of Global Bilateral Migration Flows". Working Paper no.5 of the project "WWWforEurope - Welfare, Wealth and Work for Europe".

Danzer, A.M., and B. Dietz (2008): "Economic Migration, Networks and Human Capital Transferability from the New European Borderlands. A Comparison of Five Eastern European Countries". Proceedings of the German Development Economics Conference, Zurich, 30-31 May 2008.

De Beer, J., J. Raymer, R. van der Erf and L. van Wissen (2010): "Overcoming the Problems of Inconsistent International Migration Data: A New Method Applied to Flows in Europe". *European Journal of Population*, 26:459-481.

DeWaard, J., K. Kim and J. Raymer (2012): "Migration Systems in Europe: Evidence From Harmonized Flow Data". *Demography*, 49:1307-1333.

EMN - European Migration Network (2013): "The Agenda for Growth in the EU : Why Migration Matters ? – Summary and Final Conclusions". European Migration Network Conference, Vilnius (LT), 5-6 November 2013.

Eurostat (2013): "On a New Definition of Population for Statistical Purposes". Paper for the 15th Meeting of the UNECE Group of Experts on Population and Housing Censuses, Geneva, 30 September - 3 October 2013.

Herm, A., and M. Poulain (2012): "Economic Crisis and International Migration. What the EU Data Reveal?" *Revue Européenne des Migrations Internationales*, 28(4):145-169.

INE-Spain (2013): "Exchange of information between EU Member States to improve population statistics. A proposal from INE-Spain". Paper for the meeting of the Eurostat Working Group on Population Statistics, Luxembourg, 16 - 17 December 2013.

ISTAT-Italy (2008): "Statistics on migration in Italy: a reassessment of sources and methods". Paper for the CES Seminar on "Measuring population movement and integration in a globalized world", Geneva, 10 - 12 June 2008.

Judson, D.H, and D.A. Swanson (2011): "Estimating Characteristics of the Foreign Born by Legal Status - An Evaluation of Data and Methods". *SpringerBriefs in Population Studies*, Volume 2.

Kelly, J. (1987): "Improving the Comparability of International Migration Statistics: Contributions by the Conference of European Statisticians from 1971 to Date". *International Migration Review*, Special Issue "Measuring International Migration: Theory and Practice", 21(4):1017-1037.

Kim, K., and J.E. Cohen (2010): "Determinants of International Migration Flows to and from Industrialized Countries: A Panel Data Approach Beyond Gravity". *International Migration Review*, 44(4):899-932.

Massey, D.S., and A. Singer (1995): "New Estimates of Undocumented Mexican Migration and the Probability of Apprehension". *Demography*, 32(2):203-2013.

Nowok, B., and F. Willekens (2011): "A Probabilistic Framework for Harmonisation of Migration Statistics". *Population, Space and Place*, 17:521-533.

Okolski, M., ed. (2012): "*European Immigrations: Trends, Structures and Policy Implications*". Amsterdam University Press.

Poulain, M. (1991): "Un projet d'harmonisation des statistiques de migration internationale au sein de la Communauté Européenne". *Revue Européenne des Migrations Internationales*, 7(2):115-138.

Poulain, M. (1993): "Confrontation des Statistiques de Migrations Intra-Européenne : Vers plus d'Harmonisation ?" *European Journal of Population*, 9:353-381.

Poulain, M., N. Perrin and A. Singleton, eds. (2006): "*THESIM – Towards Harmonised European Statistics on International Migration*". Presses Universitaires de Louvain.

Poulain, M., and C. Wattelar (1983): "Les migrations intra-européennes : à la recherche d'un fil d'Ariane au travers des 21 pays du Conseil de l'Europe". *Espaces, populations, sociétés*, 2:11-26.

Raymer, J., J. de Beer and R. van der Erf (2011): "Putting the Pieces of the Puzzle Together: Age and Sex-Specific Estimates of Migration amongst Countries in the EU/EFTA, 2002-2007". *European Journal of Population*, 27:185-215.

Raymer, J., and F. Willekens, eds. (2008): "*International Migration in Europe –Data, Models and Estimates*". Wiley.

Raymer, J., A. Wiśniowski, J.J. Forster, P.W.F. Smith and J. Bijak (2013): "Integrated Modeling of European Migration". *Journal of American Statistical Association*, 108(503):801-819.

Rogers, A., J. Little and J. Raymer (2009): "*The Indirect Estimation of Migration – Methods for Dealing with Irregular, Inadequate, and Missing Data*". Springer.

Statistics Austria (2008): "Migration statistics: conceptualisation and measurement in the European Union". Paper for the CES Seminar on "Measuring population movement and integration in a globalized world", Geneva, 10 - 12 June 2008.

Statistics Netherlands and Statistics Sweden (2010): "Comparing international data on migration between Sweden and the Netherlands". Paper for the Joint UNECE/Eurostat Work Session on Migration Statistics, Geneva, 14-16 April 2010.

UNECE (2010): "Guidelines for Exchanging Data to Improve Emigration Statistics". Prepared by the Task Force on "Measuring Emigration Using Data Collected by the Receiving Country". United Nations, Geneva.

UNECE Task Force (2012): "Analysis of international migration estimates using different length of stay definitions". Paper for the Joint UNECE/Eurostat Work Session on Migration Statistics, Geneva, 17-19 October 2012.

Van Hook, J., and J.D. Bachmeier (2013): "How well does the American Community Survey count naturalized citizens?" *Demographic Research*, 29(1):1-32.

Willekens, F. (1994): "Monitoring International Migration Flows in Europe - Towards a Statistical Data Base Combining Data From Different Sources". *European Journal of Population*, 10:1-42.

Willekens, F. (1999a): "Probability models of migration: complete and incomplete data". *SA Journal of Demography*, 7(1):31-42.

Willekens, F. (1999b): "Modeling Approaches to the Indirect Estimation of Migration Flows: From Entropy to EM". *Mathematical Population Studies*, 7(3):239-278.

Wiśniowski, A., J. Bijak, S. Christiansen, J.J. Forster, N. Keilman, J. Raymer and P.W.F. Smith (2013): "Utilising Expert Opinion to Improve the Measurement of International Migration in Europe". *Journal of Official Statistics*, 29(4):583-607.